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THE BIOLOGICALLY MINDED PHYSICIAN[1]

By Dr. Wm. deB. MacNIDER

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I HAVE often wondered why there were commencement addresses and why an individual should even for the moment assume such a degree of egotism as to gain the belief that he had something worth while to say on such an occasion. The only possible excuse on the part of presidents and deans in commanding such addresses is that it is of their nature to command and in addition such statements which are supposed to be buoyant with thought, tinged with advice, have become a custom, and customs are not bad things; they are at least of some value, in terms of historical continuity. More than likely on some rare and ancient occasion some individual happened to say something worth while to a group of people who were graduating, and then it was that certain high officials in academic life said this must be done each year for ever and ever, and it is done. We have found, I feel, a part of the answer to the question which I have raised, but the important part of this question for you and for me is not answered. Why do I assume for the space of half an hour, when you have been talked at and talked to for four years, that I should catch you and detain you for another period for the same purpose? I can not answer this question except that as a teacher for thirty-seven years I like to be with young people when they commence a great adventure, set their sail and make a start, and because I wanted to be here and feel the great honesty and truthfulness of Dean Hyman and to gather a certain inspiration by subjecting myself to the stimulating intellects of Professors Nash and Gibbs and to find other minds of a like order in your faculty. With such an explanation for my presence here to-night I want to detain you for a bit, not with advice which is ever so free and repugnant, but

[1] An address to the graduating class of the Medical School of the University of Tennessee, Memphis, March 22, 1937.

to talk about a fine type of physician—the biologically minded physician.

Normal, physiological life is a balanced, related existence of an organism, regardless of the type or lowliness of the organism to its ever-changing environment both within and without whatever this environment may be. The function of the adequately trained and, of more importance, thoughtful physician is to keep this ever-changing life in a balanced and related state, so that the manifestations of its life, its symptoms, may fall in that category of reactions which are called normal. It must be prevented from developing those signs of life which are abnormal and which are dependent upon maladjustments which may or may not have a structural basis for their existence. The physician is therefore concerned not with death but with life, life related as beauty and if he has wisdom and understanding his main consideration will be to recognize very early maladjusted life, attempt to furnish an explanation for it, and institute measures of a natural order to readjust it. Such measures are of a biological nature; artificial, unnatural agencies may be necessary as adjuncts. The physician must be biologically minded and through this mind attempt to see the organism as a whole in all its somatic and psychical departures from the normal. The organism furthermore must be seen as individual and related as individual in a happy, useful and effective fashion to that environment which circumstances have determined to be its environment. "Here is a task for all that a man has of fortitude and delicacy," and may I add, of science, of economics, of religion and a sympathy which relates skill pleasantly. How thrilled you should be to have selected a domain of understanding into which you can pour freely trained minds in such a biological adventure.

Operating in the order and at the level which has been indicated, a physician's life expresses itself as a field biologist and more, for he must consider social relationships, economic demands and emotional reactions in his group of diverse individuals whom he is attempting to adjust. His life is an experimental one with all the joys of investigation until years of experience have given him an understanding which enables him through accumulated reason to say you should do this or you should not do that if you care to maintain a normal balance and adjustment. He has developed medical sense of a biological order. The experimental method, insisted on by Claude Bernard and now used in the teaching of science and which should be used to understand all relationships in which life is concerned, only commences in the laboratory. Its medical use reaches its height when employed by physicians not only in hospitals but also in homes of such wealth that they have become pathological and in the quiet, kindly cottages and huts which need light from an experimentally minded and inquisitive physician. May I recall to you in this connection that the greatest of medical biologists was a tanner's son with a something within him which persisted in asking the why and the wherefore of things and who through toil guided by reason succeeded in answering some of these questions for himself and for the mind of man through experiments, many of which were essentially simple. Truth has the tendency to emerge in simple individuals and to show itself through simple experiments. And again in this same connection you will recall that the great advance made in the understanding of heart disease did not come from an elaborately mechanized laboratory but from and through the mind of a country doctor in Scotland carrying on his inquisitiveness on human beings living under thatched roofs in districts remote from medical centers. A country physician in Germany wondered (what a blessed power of the human mind to wonder) why cattle in one pasture became ill, and died, while others in an adjoining pasture remained in health. His wonderment forced him to look at the blood of sick and dead cattle, and the cause of anthrax was discovered. Pasteur, Sir James McKenzie and Robert Koch observed and wondered, their wonderment both blessed and burnt to the point of trying, through reason operating experimentally, to find out the cause for departures from the normal, and discoveries were made which advanced biology and medicine and pointed the way in certain particulars as to how mankind could be related and adjusted. May I call your attention to the fact that I have not been talking about earning a livelihood, about money or the things money can acquire. Money is refuse which comes as a by-product of thoughtful living in which happiness develops through a loss of the individual in thought and reason.

The advances accomplished by simple and great men do not come about in an incidental manner or in a hit-or-miss fashion. They are made possible through a training that may not be highly specialized in technique but one which induces thoughtfulness and breeds judgment so that measures of investigation may be applied to a variety of problems. The tasks which have to be undertaken by physicians at the present time not only require information of a specific and technical nature but also a breadth of understanding into subjects remotely related to medicine which is necessary if we recognize in an individual categories other than the physical. How comparatively easy it would be to serve in the capacity of physician to a colony of crabs or earthworms. Their necessary adaptations are in large measure essentially physical, their emotional life other than certain urges of a sexual nature must be negligible and their economic demands

are fairly simple and usually assured. How different in its physical and psychical complexity is the human life which the physician must attempt to relate in a balanced fashion and how broadly learned he must be in order to appreciate the various niches into which this life must fit and function with a smoothness which partakes of beauty. The accomplishment of this difficult task depends first upon the personality of the individual who desires to become a physician, second upon the type of academic and medical training to which he has been subjected and, finally, upon whether or not he has the understanding to see his maladjusted medical problems, but far more, his individuals, broadly, and has the urge to relate them to life and for life both physically and psychically, first by the use of natural measures and later, as adjuncts, by certain artificial measures such as surgical procedures and the employment of chemical agencies in the form of drugs.

It would be most helpful to officers of administration in medical schools to have a given series of tests which could be applied to prospective medical students with the object in view of determining whether or not they have within them those qualities which after having been allowed to operate through a medical curriculum will result in the development of the type of understanding physician which we desire and which the public should want. So far as I am aware there are no such series of tests and there can not be, for individuals have the quality of growth and change within them, and the main function of the medical school is to permit growth and change in the direction of an ideal. It is impossible to look into the face of an individual or to note certain reactions in terms of percentages and determine the potentialities of his brain cells. Their power and biological effectiveness depend so much upon stimuli to which they will be subjected; teachers, for instance, who may drone through intellectual possibilities, or sparks of fire, torch bearers who are also teachers who may consciously or unconsciously transmute the laggard, a dead leaf, who under their influence becomes a living butterfly. The student without promise finds himself. There was something in him which needed a spark, a guide and a subject to release him and permit him to express and relate himself in reason through thought. Attempts have been and are now being made to find out the mental powers of students by employing mechanistic devices which find their end reaction in a card index system. Aptitude tests consisting in rather detached questions in a variety of subjects are supposed in their foolishness to stimulate such answers that an individual may be considered intellectually fit as a medical student and accepted or rejected on this basis. A knowledge of the population of Calcutta would indicate whether or not a student is capable of handling a microscope. With an appreciation of certain biological principles, I would rather have talk with the prospective student and learn of the kind of stock from which he came. What did his forebears do and how did they do it? Did they live dependable lives? Were they psychically adjusted? Such considerations, which may be extended generally, give an admitting officer an idea of the type of stuff he is dealing with and generally the order of reaction he may expect to obtain from it. Furthermore, students going into medicine must have at least two and preferably four years of premedical training. During these years the numerical evaluation of students becomes available in the form of grades. Such records certainly have significance as such and also usually indicate the likes of students. Was he fond of biology, chemistry and physics? Were they delights which impelled him to work overtime? Regardless of grades this happy worker in subjects definitely related to medicine would attract my attention rather than the indiscriminate gatherer-in of grades. The evaluation of the spirit of an individual is most difficult and a card indexing system is not infrequently inadequate for such an evaluation. This may be the thought behind the custom in many medical schools of having students who desire to enter medicine consult regional representatives of the school under consideration. Such a method of evaluation is natural. It is far removed from an aptitude test but furnishes information of an intimate nature. An individual with a collection of A's and B's and with an accurate knowledge of the population of Calcutta might be eliminated if he appeared for such a conversation collarless, with his shirt front ajar and with gaudy socks gracefully draping his shoe tops.

In certain academic communities there are individuals who are designated premedical deans. Such people of the right sort may be most valuable to the premedical student and to the dean-to-be of such students. Such a person may be the guide, the contact to touch off the spark in students for medicine. This can not be done by a statement that our requirements are this and that, you must get them at this numerical order of excellence or you can not go into medicine; but he can veil these ugly truths with the fineness and greatness of scientific thought as shown by the lives of great biologists and chemists and biologically minded physicians. Through biography the student is given an ideal, and this gives him an urge to so accomplish his tasks that he may live his life as a Marion Sims, a Theobald Smith, an Osler or a Thayer or at least yearn for those things which they accomplished by living thoughtfully in simple honesty. The premedical dean I have in mind will not forget that these physicians to be under his guidance "can not live by bread alone,"

that they must have life and, furthermore, aid life pleasantly in others. With all the dean's appreciation of and insistence on the premedical sciences, he will see to it that these students at least have an introduction to other values which may be found in prose and in poetry, in history and in economics. It is through such appreciation that the scientist and physician gain a poise and a peace. They have comforters to turn to during periods of stress and misunderstanding, which will enable them to permit time to untangle the skein, for natural forces to assert themselves and lead to workable adjustments. The student who has this type of training over and above his scientific training can generally keep his feet on the ground and his head in the air. He is well balanced. He uses Wordsworth rather than a caffein beverage and prefers the New Testament to a highball. He is able to withstand adversity and, of more importance, indulge in success without glory and with humility.

Within the medical school students selected and prepared for it enter a specialized division of biology to gain an understanding of the human organism. For what purpose and in what form are they going to use this information and training? The form in which information and training is used is of importance, for through form in the practice of medicine there is given an opportunity for the personality, training, understanding and ideals of the individual to express themselves. Formalities may be superficialities or idiosyncrasies and are usually unnecessary, but the form of life, the form of practicing a profession, is very different from a formality. Good form is the basis of the good life, of the fineness of the good physician, of the good anything which is related to life at a high level of excellence. The biologically minded physician relates himself through good form to his varied problems in many types of individuals.

A premedical student, a student of medicine, a physician, should ask himself for what purpose he has entered this profession. Does he desire first and foremost to make money? Such a thought is so far removed from the biologically minded physician that it would appear crude to raise it and yet there is an ever-increasing number of students who are going into medicine not to become lost in its scientific and applied beauty, not to give and to continue to give in order to be found, but for the purpose of financial and social gain. Such individuals are more dangerous to the profession than are the honest, duly and truly labeled quacks and charlatans, for the first group, cloaked in academic garb and wearing the insignia of doctors of medicine, are not in the open. They are difficult to handle through medical organizations or through legal procedure. Success for them is money, and sooner or later, usually the former, they resort to practices which will enable them to secure money. The dapper surgeon with an ever ready operation, the blundering internist with a composite prescription combining all the glands of internal secretion or the six-week, not six-year, specialist with bluff and self-assurance intrigues the sick and sore at heart into their mercenary care without a thought of a biological nature. One can hardly believe that such prostitutes exist. They do. No vice was the cause of their medical degradation. The cause was the desire for money and for those ephemeral pleasures which money secures. Such individuals know nothing of the durably satisfying things in life. A restoration to health means more patients in terms of more money. A sunset to them is only red. The cry of a child is the call for paregoric and the transfer of coin.

There are students who desire medical training in order that they may do what is known as minister to suffering humanity, to ease pain, to bring happiness to a home which was in sorrow. A medical student, a physician, who does not want to do this should abandon medicine. Rather frequently, however, this type of medical student wants to acquire his medical training with ease. He is sentimentally minded rather than biologically minded. He is superficially helpful, his major objective is to obliterate distressing though useful symptoms rather than to participate in the usefulness to the patient and the satisfaction to himself of having ferreted out the cause of the symptoms and, if possible, removing the cause. Not infrequently this type of physician speaks of indigestion as though it were an entity and prescribes an inert preparation of pepsin for its correction or he narcotizes his own appreciation and judgment and the sensitiveness of his patient with morphine; he uses purgatives in place of an enema, digitalis instead of a bed. This type of medically inclined person is dangerous not because he is a knave but because he is superficially kindly and wants very earnestly to be helpful without being thorough. He is not biologically minded. Not infrequently individuals with this fine sentimental urge long for the medical foreign mission field or for remote country districts where they can put into practice their superficial understanding of an intricate and applied science. The human organism as such and as an individual is just as complex and requires just as much understanding care in the Yangtze Valley and in a mountain cove in North Carolina as it does at Memphis or in Chapel Hill. There can be only one type of physician and there can be only one order of medical school; both, however, with an elasticity which will enable them to acquire and impart medical information which is ever increasing in its complexity and applied usefulness. I am well aware there are thoughtful people who fear that medical men and women of this type of

training will not locate in remote districts and fear that even if they should they will fail to adjust themselves to individuals and situations found in such localities. In a measure they do not have to. Good roads, the automobile and the telephone are agencies which have changed or are in the process of changing, for all time, a type of isolated medical practice which was once known as country practice. This change has been greatly facilitated and perfected by the development of small, privately owned or community owned hospitals. The Mayo Foundation had its origin in a small village serving at first a rather isolated rural community. From such small centers of medical excellence a country district can be served expeditiously and also with fine medical understanding.

There is an ever-increasing number of medically minded people who enter medical schools to obtain scientific information concerning the normal and abnormal human being as organism, and if they be wise, certainly if they intend to apply this information, they will acquire an understanding of this organism as an individual and as a related individual, both biologically and socially. The type of medical instruction required for such a purpose has become more and more elaborate as the science of medicine has advanced through the acquisition of new truth, on the one hand, and both the necessity and the ability of this information to be applied in an illness in an attempt to relate and adjust abnormal individuals. As a result, the curriculum in most medical schools has become, to an extent, standardized through an attempt to impart to its students an adequate amount of such accumulated information so that, with both science and sympathy, they may be safe guides through an illness. It has become impossible for the information in any one of the subjects to be given in detail. This is fortunate for both the instructor and the student. For the instructor it should allow leisure for study and research in the high hope that he may, through creative work, make some slight contribution to his division of understanding. For the student it should permit time for him to express his purpose in the extent and detail to which he can inform himself, with some guidance, in the various subjects of the curriculum. He becomes an investigator and carries this point of view into his practice. He may be permitted to aid in experimental work not only for his edification but also in the hope that such work will stimulate him to go further in learning before he has to so largely concern himself with applying.

As a result of medical research of a biological order, the character of the departments in the medical curriculum has changed amazingly, and this change, which has been for the better, has reflected itself in physicians. The dissecting room, which at one time dominated the entire curriculum, is now, and should be, a useful adjunct to the anatomical laboratories in which it becomes difficult to know whether physiology or experimental morphology is the subject under consideration. The department of biological chemistry has evolved from a laboratory mainly concerned with urinalyses to one in which the higher realms of organic synthesis are considered worth while and which is now in the process of finding itself in chemical problems of a medical character essential to the understanding of the biology of the sick individual. Medicine can not be practiced without this information and the ability to apply it. Physiology, once fairly content to use hours upon hours of a student's time for the understanding of nerve-muscle preparations, goes to the wards to lose itself in unraveling the intricacies of pathological physiology, both for the delight of the student and the welfare of the sick individual. Pathology appears to be participating in an intellectual resurrection. Death is no longer its goal and the dead house its delight. The experimental pathologist who is interested in tissue changes prior to their dissolution, in the ability of tissues to react to injury and to participate in repair, to shift and adapt themselves and yet to function, has given this subject a new light and life upon which clinical judgment must rest in its attempt to modify states of disease by the use of mechanical agencies and chemical measures. There has emerged from a something once known as materia medica a highly specialized pure science, which may be knowingly applied to both normal and pathological tissues, which is now designated pharmacology. This science no longer introduces chemicals into tissues in the darkness of ignorance, without reason and on an empirical basis, but does this in the light of scientific understanding of how a given chemical body may influence normal tissue response and, furthermore, how this response may be modified by states of disease within tissues. Its reach as a pure science and applied as therapeutics is difficult to estimate, for it is in its period of development which in turn very largely depends upon information which the chemist and physiologist will give to it. The name drug is distasteful. It recalls a period when a combination of substances in the form of a prescription was unknowingly introduced into an organism of unknown physicochemical constitution in the hope that something for the betterment of the individual might happen. Such ignorance is in the process of vanishing through the combined research of the pharmacologist and biological chemist. More and more we are being placed in the position of being able to say that a part of the maladjustment of this individual is due to the fact that there is a deficit or an excess in terms of milligrams of a given substance in this organism; therefore, we will balance it in this particular and see what adjust-

ment it can make. Or, the reaction of this tissue is in excess of what it should be or is below what it should be; we will, therefore, introduce this chemical agent in an attempt to modify the reaction to a point where it will at least not be harmful and may be of definite value in the process of biological adjustment. Pharmacology is of particular importance in the medical curriculum and assumes a most significant place in it since it takes for its advancement biochemical, physiological and pathological understanding and carries them through its applied outlet to the bedside in an attempt, by the use of certain chemicals, to modify the untoward symptoms of disease, to facilitate recovery from disease and, with increasing certainty, to eliminate the cause for the departure of the individual from a balanced state of life.

There was a time when the medically minded biologist had, in a measure, to forsake reason and act with what was called common sense, and it was. This occurred when he entered the hospital or found himself at the bedside of a patient other than in a hospital. This is no longer the case. The training of the premedical years and in the medical curriculum permits the one type of reasoning with the same limitations, which become less with each year, to be used now, whereas it at one time could only be used in the laboratory, at the bedside, whether that bedside happens to be in the elaborately appointed private pavilion of a hospital or in the humblest home. Scientific understanding as truth undergoes no modification as a result of situations and circumstances. The modern medical man and woman are therefore no longer healers by chance in a haphazard fashion. As individuals with personality, through training of a general and broadly biological character they have become biologically minded physicians who see it as their function to ascertain the cause for physical and psychical maladjustments and to institute such measures, if possible of a natural order, to readjust to their environment, whatever that environment has to be, individuals who have been forced to depart from it. Such a life is a sound life, for it deals with and lives in nature through reason. It is a happy and useful life, for it gives itself that others may find themselves in a related, balanced fashion which slowly but certainly leads to perfection of the body and through mind to the understanding on the part of such a body of values which are real, durably satisfying and which, in the end, become both lost and found in beauty.

> . . . There's magic all around us
> In rocks and trees, and in the minds of men,
> Deep hidden springs of magic.
> He that strikes
> The rock aright, may find them where he will.

OBITUARY

ARTHUR BROOKS CLAWSON

ARTHUR BROOKS CLAWSON, widely known for his work on plant poisoning of live stock, died at his home in Washington, D. C., on June 30, of cerebral thrombosis. He was born in Green Lake, Wis., on June 18, 1878, and was educated at Ripon College, the University of Michigan and the University of Wisconsin. He taught biology at Lake Forest College, Illinois, for two years and joined the staff of the Bureau of Plant Industry in 1909. He became associated with the group investigating stock poisoning by plants, then an activity of that bureau and spent the remainder of his life in that field, finally taking charge as physiologist, Bureau of Animal Industry, in 1930. He was in charge of the Experiment Station at Salina, Utah, maintained by the latter bureau for the study of stock-poisoning plants, and at the time he was taken sick was on the Utah deserts studying the disease known as bighead. He published a number of papers on the subject of plant poisoning, including papers on larkspurs, loco weeds, lupines, cyanogenetic plants, milkweeds and Senecio among others. He was easily the foremost American authority in this field and enjoyed the confidence of live-stock breeders, to whom he was of constant assistance. He had nearly finished his work on bighead in sheep and had for the first time demonstrated that certain plants are responsible for this serious condition, which annually causes large economic losses to breeders.

Quiet and unassuming, he was indefatigable in pursuing his researches and possessed an unusually complete knowledge of the western stock ranges and practises in live-stock raising. He was a member of the Washington Academy of Sciences, the Biological and Botanical Societies of Washington, Illinois Academy of Science, Wisconsin Academy of Science and Sigma Xi, and was a fellow of the American Association for the Advancement of Science.

J. F. C.

CHARLES DWIGHT MARSH

BIOGRAPHICAL facts concerning eminent men of science are too often lost to posterity through failure of those who have such facts to preserve or record them. This is true not only of the usual biographical details but also of the equally important but more evasive particulars of a man's personality—what others thought of him, what were his aspirations and bents and what he was to the world and to his community as well as to his scientific colleagues. Even

scientists are human entities—you can not separate their work from their wills or their science from their souls.

There has just come to my attention a biographical sketch of and tribute[1] to Dr. Charles Dwight Marsh (1855–1932), written by his widow, Mrs. Florence Wilder Marsh, and it is fitting that it be noticed in SCIENCE. Dr. Marsh[2] attained scientific distinction in three fields: in teaching, in his researches on toxic plants for the U. S. Department of Agriculture, and in his plankton studies, especially of the copepod crustaceans,[3] on which he was a recognized authority, being at the time of his death honorary curator of Copepoda in the U. S. National Museum.

Privately printed, Mrs. Marsh's account of her husband's life is dignified, unpretentious and inspiring, and it should be especially valued by his former students and associates—and there were many of them—who came in contact with his fine personality. This little memoir should be a model too for others, especially families, who have within their knowledge and keeping biographical material not otherwise available concerning men of science who have passed on. It shows how such data and personalia can be presented, modestly and all in good taste, for those who care to know. This sketch, too, it should be added, has an excellent profile portrait of Dr. Marsh.

PAUL H. OEHSER

U. S. NATIONAL MUSEUM

RECENT DEATHS

DR. FREDERIC B. LOOMIS, professor of geology at Amherst College, died on July 24 at the age of sixty-three years.

DR. HENRY S. DRINKER, mining engineer, president of Lehigh University from 1905 to 1920, died on July 27 at the age of eighty-seven years.

JOHN WHITE HOWELL, who resigned in 1931 as engineer of the Edison Lamp Works of the General Electric Company and who had previously worked with Thomas Alva Edison in the development of the incandescent lamp, died on July 28 at the age of seventy-nine years.

DR. JACOB DINER, retired dean of the Fordham University College of Pharmacy, which he organized in 1912, died on July 25. He was sixty-seven years old.

DR. SYDNEY CONTENT BOETH, emeritus professor of agriculture at the University of Reading, died on July 19 at the age of sixty-eight years.

SCIENTIFIC EVENTS

NOTTINGHAM MEETING OF THE BRITISH ASSOCIATION

THE annual meeting of the British Association will this year be held in Nottingham from September 1 to 8, under the presidency of Sir Edward Poulton. *Nature* writes that twice previously the association has held its annual meeting in Nottingham. In 1866, before the foundation of University College, Nottingham, Mr. Justice Grove, Q.C., the inventor of the Grove cell, was president. Wheatstone was president of Section A (Mathematics and Physics), before which Joule read a short paper on the heating effect of an electric current in a wire. Sir William Huggins gave an evening discourse on the applications of spectroscopy to the problems of stellar constitution. Among the more distinguished members present in 1866 were Frank Buckland, T. H. Huxley, A. R. Wallace, W. Crookes and H. E. Roscoe.

In 1881 the University College, Nottingham, buildings in Shakespeare Street were opened, and these were the headquarters of the association at its annual meeting in 1893. Dr. J. S. Burdon Sanderson was president, and Sir Richard Glazebrook was president of Section A, at which a committee presented a report on the foundation of a National Physical Laboratory.

This year the association will hold its sectional meetings in the University College buildings in University Park, provided by the munificence of the late Lord Trent and opened in 1928.

The Geography and Geology Sections are combining in a discussion on the potential resources of the area; there will be an evening discussion arranged between six sections on the planning of the land of Britain and a joint meeting of the Education and Geology Sections to discuss the teaching of geology in schools. The address of the president of the Education Section will be given by H. G. Wells. In addition to the evening discourses, one on "Illusions of Color," to be given by Professor H. Hartridge, and another on "Grass and the National Food Supply," by Dr. R. E. Slade, a series of popular lectures for non-members has been arranged in the neighboring towns. Dr. Alexander Wood will address a company of Nottingham children on "Noise"; Sir Gilbert Walker will talk to a Derby audience on "The Science of Sports"; Mr. R. Kay Gresswell will speak on "Rivers" at Lincoln; Dr. J. E. Constable, on the "Every-day

[1] Privately published; dated December 25, 1935. Mrs. Marsh's address is 1882 Monroe Street, N.W., Washington, D. C.

[2] Dr. Marsh's death was noted briefly in SCIENCE, 75: 506, 1932; and *Jour. Wash. Acad. Sci.*, 22: 292, 1932.

[3] A complete bibliography of Dr. Marsh's contributions to the literature of the Copepoda, published over a period of forty-three years, appeared in *Proc. U. S. Nat. Mus.*, 82: art. 18, 57–58, 1933.

Applications of Physics," at Long Eaton; Professor J. Walton, on "Coal and its Origin," at Mansfield; and T. M. Herbert, on "Transport of Food," at Newark.

The Lord Mayor and members of the City Council will hold a civic reception at Nottingham Castle on Thursday evening, September 2, and the College Council will give a garden party on September 7.

AWARDS OF THE ELLA SACHS PLOTZ FOUNDATION

DURING the thirteenth year of the Ella Sachs Plotz Foundation for the Advancement of Scientific Investigation, ninety-two applications for grants were received by the trustees, thirty-five of which came from the United States, the other fifty-seven coming from twenty-one different countries in Europe, Asia, Africa, Australia and North America. The total number of grants made during this year was thirty, one of these being a continued annual grant. Eighteen of the new grants were made to scientists outside of the United States.

In the thirteen years of its existence the foundation has made two hundred and eighty-two grants, which have been distributed to investigators working in Argentina, Austria, Belgium, Canada, Chile, China, Czechoslovakia, Denmark, Esthonia, France, Germany, Great Britain, Greece, Hungary, Italy, Jugoslavia, Latvia, Netherlands, North Africa, Palestine, Poland, Portugal, Roumania, South Africa, Sweden, Switzerland, Syria, Venezuela and the United States. The maximum size of the grants is usually less than $500.

The list of investigators and the purpose of their researches aided in 1936 is as follows:

Dr. Melville Arnott, Edinburgh, for research into the connection between renal damage and hypertension.

Dr. Zoltan Aszodi, Budapest, for work on slowly absorbed insulins.

Professor B. P. Babkin, Montreal, for continuation of histo-physiological investigation of the digestive glands.

Professor Dr. H. K. Barrenscheen, Vienna, for study of free nucleotides in various animal organs.

Professor Howard H. Beard, New Orleans, for continuation of studies on the origin of creatine.

Professor Leon Binet, Paris, for study of the rôle of glutathione in the animal organism.

Dr. Matilda Moldenhauer Brooks, University of California, for study of infra-red and ultra-violet absorption spectra of various hemoglobin compounds.

Professor R. Courrier, Algiers, for research on sexual physiology in monkeys.

Professor Paul L. Day, University of Arkansas School of Medicine, for investigations on nutritional anemia and leukopenia in the monkey.

Dr. H. B. Fell, University of Cambridge, for nutritional studies by Miss Glasstone.

Professor M. Florkin and Dr. Z. M. Bacq, Liége, for work on: (1) Metabolism of phenylamines in the mammalian body. (2) Action of drugs and the autonomic nervous system on blood potassium. (3) Action of anti- and pro-oxydant substances on adrenaline and sympathetic action on smooth muscle.

Dr. Ludwik Gross, Paris, for cancer research.

Professor Laurence Irving, Toronto, for experiments on vestibular-vasomotor relations.

Professor George Karagunis, Athens, for work upon the production of an optically active substance from inert material under the influence of an asymmetrical force.

Dr. Esben Kirk, Copenhagen, for research on the lipid content of the red blood cells under normal conditions and in anemias.

Dr. John S. Lawrence, Strong Memorial Hospital, Rochester, N. Y., for work on problems dealing with the development of an antineutrophilic serum in order to learn more about leukemia.

Professor C. Levaditi, Paris, for work of determining certain physical properties of ultraviruses.

Dr. John R. Murlin, University of Rochester, for investigations into the mechanism of secretion: (1) The secretion of the intestinal glands. (2) The secretion of the mammary gland.

Professor W. C. W. Nixon and Professor L. T. Ride, Hong-Kong, China, for investigation of the hematological and dietary aspects of a high (10 per cent.) incidence of œdema of pregnancy, both before and after parturition, in Hong-Kong.

Dr. Eric Ponder, The Biochemical Laboratory, Cold Spring Harbor, L. I., for study of white cells under various conditions.

Dr. Samuel Proger, the Boston Dispensary, for continuation of work on the effect on patients with heart disease of lowering the level of energy metabolism by means of prolonged dietary restriction.

Dr. Wilhelm Raab, Vienna, for research on proteolytic enzymes of carcinoma tissue, also on the influence of hormones upon the development of arteriosclerosis and high blood pressure.

Professor Louis Rapkine, Paris, for work on the oxidation-reduction potentials of cells and the mechanism of cell division.

Dr. William T. Salter, Huntington Memorial Hospital, Boston, for study of the enzyme production and physiologic effect of the plasteins of thyroglobulin and of insulin.

Dr. Francis Schwentker, Baltimore, City Health Department, for study of the biological mechanisms involved in postscarlatinal nephritis.

Dr. Yellapragada SubbaRow, Harvard Medical School, for further study of the structure of the compounds active in pernicious anemia; continuation of work on experimental black tongue; and, if possible, to try the curative properties of these substances on human pellagra.

Thorndike Memorial Laboratory, Boston City Hospital, (Professor George R. Minot, director), continued since 1927 in recognition of Dr. Francis W. Peabody's services to the foundation.

Professor Dr. F. Verzar, Basel, for continuation of physiological research on absorption connected with adrenal cortex, by Dr. Laszt.

Professor Dr. Ernst Wertheimer, Jerusalem, for continuation of the study of the relationship between free and bound glycogen in normal and pathological conditions.

Dr. M. M. Wintrobe, the Johns Hopkins Hospital, for continuation of studies of macrocytic anemia in animals.

DEGREES CONFERRED BY THE UNIVERSITY OF EDINBURGH

Among the honorary degrees conferred at the graduation ceremonial of the University of Edinburgh were the doctorate of laws on Dr. Leo Hendrik Baekeland, president of the Bakelite Corporation, honorary professor of chemical engineering at Columbia Unversity, and on Sir William (Henry) Bragg, president of the Royal Society. The degrees were conferred by Sir Thomas Holland, vice-chancellor and principal of the university. Candidates for the degree of doctor of laws were presented by Professor James Mackintosh, dean of the faculty of law. The citations were as follows:

"Born in Ghent in 1863, Leo Hendrik Baekeland, having won his doctorate in chemistry and the hand of his professor's daughter, emigrated to America, where he engaged in chemical research. The first fruit of his investigations was Velox printing paper, long prized for its sensitive qualities by photographers throughout the world. After effecting certain improvements in the apparatus used in the production of caustic soda and chlorine, Dr. Baekeland turned his attention to synthetic resins. He found that phenol and formaldehyde interacted to yield an insoluble, infusible material, which looked like amber, but had much more serviceable properties. Here was a super-resin which nature had not furnished; it had been built to specification in the research laboratory. This substance, called Bakelite after its parent, now meets us at every turn in our daily life. It is there when we turn on the electric light, the wireless set, or the gramophone record; it provides us with fountain pens, billiard balls, even artificial dentures—in truth, it enters into every modern contrivance for our convenience or discomfort. Meanwhile, its genial inventor dives for sponges from his yacht off the coast of Florida and continues to devise fresh methods for their utilization. His career is indeed a striking example of the romance of applied science, which has brought him high honor in the land of his adoption, and is eminently worthy of being crowned with our academic laurel."

"Sir William Bragg won his earliest laurels in the Cavendish School at Cambridge, the greatest nursery of experimental physics in this country. After Cambridge he found for a time a quiet haven for reflection and experiment at the Antipodes. It was felt, however, when his fame came to be noised abroad, that he should not be left too long to 'waste his genius on the desert air,' and he was brought back to occupy the chair of physics in the Universities of Leeds and London successively, and was ultimately promoted to the directorship of the Royal Institution of Great Britain, a position for which he was eminently fitted by his zeal for the application of scientific methods to new problems and his gift of infecting others with the same enthusiasm. His early work on x-ray diffraction, leading up to the design of a spectrometer applicable to the study of crystals, was undertaken in collaboration with his son, Professor W. L. Bragg, and was recognized by the joint award of the Nobel Prize for Physics in 1915. During the war the Admiralty placed Sir William in charge of an experimental station for the investigation *inter alia* of methods for the detection of submarines. Since that time a band of crystal gazers under his supervision have perfected a technique for determining the structure of crystals, and they now form the acknowledged vanguard in crystallographic research. The high position Sir William has attained in the world of science is shown by the many distinctions that have been bestowed upon him, and he enjoys the special gratification of seeing the directorship of another great national institution—the National Physical Laboratory—in the hands of the son who inherits his talents. Unfortunately, science has not shown us how to split the doctorate of laws; for the present we must be content to award it *pro indiviso*—as a birthday gift, I am happy to say—to the distinguished President of the Royal Society."

SCIENTIFIC NOTES AND NEWS

Dr. Ross G. Harrison, Sterling professor of biology at Yale University, has been elected a foreign honorary member of the Royal Academy of Medicine of Belgium.

The University of Belfast on the occasion of the recent meeting there of the British Medical Association conferred the degree of doctor of laws on the president of the association, Sir E. Farquhar Buzzard, professor of medicine in the University of Oxford.

The James E. Stacey award of the University of Cincinnati, consisting of a gold medal and $100, was recently presented to Dr. Edward C. Rosenow, professor of bacteriology and immunology in the Graduate School of Medicine of the University of Minnesota, Rochester, Minn., "because of recent establishment of the fact that certain types of spasmodic disease—such as chronic hiccup, torticollis and other types of spasm involving particularly the respiratory muscle group—

were dependent on central nervous system infections originating in symptomless infections of the tonsils, from which micro-organisms and toxins were recovered which on injection into experimental animals reproduced identical forms of the disease."

PRESENTATION of the Trudeau Medal to Dr. Charles J. Hatfield, associate director of the Henry Phipps Institute of the University of Pennsylvania, was made at the recent annual meeting in Milwaukee of the National Tuberculosis Association.

THE Royal Society of Tropical Medicine and Hygiene has awarded the Chalmers memorial gold medal for tropical research to Professor R. M. Gordon, of Sierra Leone, and the presentation was made at the annual general meeting on June 17. The medal is awarded every two years "in recognition of research of outstanding merit contributing to the knowledge of tropical medicine or tropical hygiene." The recipient must be under forty-five years of age at the time of the award.

COTHENIUS MEDALS of the Halle Academy of Sciences have been awarded to Dr. George Barger, professor of chemistry at the University of Edinburgh, and to Dr. Dante de Blasi, professor of hygiene and legal medicine at the University of Naples.

THE gold Sven-Rinman Medal of the Swedish "Eisenkontor" has been awarded to Dr. Friedrich Körber, director of the Kaiser Wilhelm Institute for Iron Research.

DR. WILLIAM DEB. MACNIDER, Kenan research professor of pharmacology at the University of North Carolina, has been appointed dean of the Medical School of the University of North Carolina, to succeed Dr. Charles S. Mangum, who has asked that he be relieved of the deanship to devote full time to teaching. Dr. Mangum was appointed dean in 1933 following the resignation of Dr. I. H. Manning. Dr. MacNider has been a member of the faculty for thirty-eight years.

AT the University of Missouri, Dr. Rudolph Bennitt has been advanced to a full professorship. He will be at the head of the program of wild-life studies now in process of development at Missouri in conjunction with the newly established State Conservation Commission and other agencies.

THE REV. DR. JAMES B. MACELWANE, S.J., has been appointed director of an Institute for Geophysics which has been established at St. Louis University. It is planned that the institute become a clearing house for geophysical records and related studies of earth structure in the Central States. Its inauguration was made possible by gifts to Father Macelwane from prominent St. Louisans.

AT Western Reserve University, Dr. Calvin S. Hall, assistant professor of psychology at the University of Oregon, has been appointed associate professor of psychology and acting head of the department of psychology; Dr. Harold S. Booth has been promoted from associate professor to professor of chemistry, and Dr. Robert E. Burk, from associate professor to professor of chemistry.

DR. PASCAL BROOKE BLAND, professor of obstetrics at Jefferson Medical College, has retired with the title professor emeritus and Dr. Norris W. Vaux, clinical professor of obstetrics, has been appointed to succeed him. Dr. Horace James Williams has been appointed professor of otology to succeed the late J. Clarence Keeler.

AT Pennsylvania State College, Dr. Woldemar Weyl, of the Kaiser Wilhelm Institut für Silikatforschung, Berlin-Dahlem, has been appointed professor of glass technology in the department of ceramics, effective on January 1, 1938. R. V. Boucher, formerly national research fellow at Yale University and recently nutrition specialist for the American Can Company, has succeeded J. E. Hunter as research professor in poultry nutrition in the department of agricultural biochemistry.

THE following promotions have been approved by the Board of Trust of Vanderbilt University: Dr. Edna H. Tompkins, associate professor of anatomy; Dr. Morton F. Mason, assistant professor of biochemistry; Dr. Roy J. Morton, assistant professor of preventive medicine and public health; Dr. Herbert C. Francis, assistant professor of radiology.

DR. W. ALFRED LALANDE, JR., assistant professor of chemistry at the University of Pennsylvania, has been awarded a George Leib Harrison fellowship for research for the year 1937–1938. Dr. LaLande will continue his work on the polyterpenes, especially abietic acid, at the Institute of Technology, Zurich, with Professor L. Ruzička. He also plans to visit other laboratories where work on natural organic substances is in progress.

ROY B. WILLIAMS, construction engineer of the All-American Canal and Gila projects, with headquarters at Yuma, Ariz., has been made assistant commissioner in the U. S. Bureau of Reclamation. L. J. Foster, of the bureau, has been appointed construction engineer of the canal.

DR. G. W. SCOTT BLAIR, of the department of physics, Rothamsted Experimental Station, has been appointed head of the department of chemistry at the National Institute for Research in Dairying, Shinfield, near Reading. Dr. Blair has been a member of the staff at Rothamsted since 1926. Some years ago he held a Rockefeller fellowship at Cornell University.

Dr. Frederick Wallace Edwards has been appointed a deputy keeper in the department of entomology of the British Museum. He undertook collecting expeditions on behalf of the museum to Patagonia in 1926–27 and to East Africa in 1934–35.

The chief geologist of the U. S. Geological Survey, Dr. G. F. Loughlin, is engaged in the examination of certain manganese and other mineral deposits in Maine. Dr. H. E. Gregory, of the survey, has resumed his studies of the geology, physiography, etc., of the plateau region in Utah. In these studies he has cooperated with the National Park Service in supplying descriptions of geologic features in areas embraced in national parks and monuments.

Watson Davis, director of Science Service and president of the American Documentation Institute, has been appointed by the Secretary of State chairman of the delegation of the United States to the World Congress of Universal Documentation to be held at Paris from August 16 to 22. Mr. Davis will sail on August 4 and while in Europe he will visit scientific institutions in various countries and attend on behalf of Science Service the meeting of the British Association for the Advancement of Science at Nottingham beginning on September 1.

William D. Campbell, field associate of the department of mammalogy of the American Museum of Natural History, sailed on July 29 for Africa to obtain material for five habitat groups in the Akeley African Hall of the museum. He expects to be in the Sahara for six weeks, starting from Khartoum. Major W. V. D. Dickinson, who accompanied Mr. Campbell on his previous journeys, will join him in Africa.

Donald Mackay, the Australian explorer, and three companions left Sydney, Australia, on July 19, in three aeroplanes to make an aerial survey of little-known parts of the interior from Tanami and Wave Hill, in Northern Territory. Thence they will cross the desert to the Western Australian coast.

Dr. Ejnar Hertzsprung, director of the University Observatory at Leiden, who was awarded in February the Catherine Wolfe Bruce Gold Medal for 1937 of the Astronomical Society of the Pacific, has arrived in the United States. He expects to take up at the Lick Observatory the work of the newly established Alexander F. Morrison memorial research associateship. The presentation of the medal will take place during his stay in the United States.

Dean J. McLean Thompson, of the University of Liverpool, sailed for England on July 31. He had been visiting professor of botany at the Iowa State College during the first summer term, teaching courses in advanced floral morphology and evolution of plants. In addition, he gave seminar addresses on "Teaching Botany in English Schools," "The Morphology of the Filicales" and a public lecture on "Plants and People of Tropical America."

The twenty-second annual meeting of the Optical Society of America will be held at the Lake Placid Club in the Adirondacks, on October 14, 15 and 16. A special program of invited papers is being arranged on the general topic of optical materials. Papers are being prepared on the following subjects: Optics and the Glass Industry, The Availability of Optical Glasses, Glass Requirements of the Optical Manufacturer, and Crystal-Growing for Optical Purposes. The program committee is attempting to leave afternoons free for recreation, except as this time may be required for committee meetings and similar activities. Presentation of the Frederic Ives Medal will be made at the annual dinner, which will be held on Friday evening, October 15. The meeting will be open to non-members as well as members of the society. Further information may be obtained from Dr. L. B. Tuckerman, secretary of the Optical Society of America, National Bureau of Standards, Washington, D. C.

The forty-fifth annual meeting of the American Psychological Association will be held at the University of Minnesota under the presidency of Professor Edward Chace Tolman, of the University of California, from September 1 to 4.

The American Chemical Society will meet at Rochester on September 6, not on September 11, as stated in the issue of Science for July 9. The meeting will continue through September 10. The headquarters will be the Seneca Hotel and all the meetings of the divisions will be held in the downtown section of Rochester as close to headquarters as satisfactory rooms can be found.

The ninth annual meeting of the Society of Rheology will be held at Akron, Ohio, on October 22 and 23. A correspondent writes: "A member society of the American Institute of Physics, the Society of Rheology is a relatively small group concerning itself with the flow of matter under stress. Specific properties studied include viscosity, plasticity, consistency, elasticity and others of like nature. These properties are of great interest to a wide variety of industries since many products depend for their perfection upon flow characteristics, as well as to those in academic research since many fundamental concepts can be based upon observed stress-flow relations. Discussions in this group are invariably free and enlightening. It is felt that many physicists actively interested in rheology have failed, through oversight, to avail themselves of opportunities offered by the Society of Rheology. It is hoped that these physicists will plan to attend the Akron meeting."

THE fourth International Leprosy Conference, of which Dr. Victor G. Heiser is president, will be held in Cairo, Egypt, beginning on March 21, 1938. This conference is being organized by the International Leprosy Association and is the first international conference to be arranged by this association since its inauguration in 1931. Three previous conferences have been held—at Berlin in 1897, at Bergen in 1909 and at Strasbourg in 1923. The Egyptian Government is inviting all countries concerned to send official delegates. In addition to these, physicians and others interested in the subject are invited to be present. Full information can be obtained from the Secretary of the International Leprosy Association, 131 Baker Street, London, W.1.

WE learn from the *Journal* of the American Medical Association that the second International Congress for Protecting Children will be held at Rome, from October 4 to 8. The first one was held at Paris in 1933. The welfare of children will be discussed in separate sections from social, forensic, hygienic and sanitary points of view. The topic for discussion at the hygienic and sanitary sections will be prevention of infant mortality due to nutritional diseases, establishment of climatic colonies for children of preschool age, care of the health of European children living in colonies, physical education of children attending grammar schools and the prevention of inferiority in the health of illegitimate children. The general secretary to the congress is Professor G. B. Allaria, of the pediatric clinic of Turin. Shortly before the congress takes place, the fourth International Congress of Pediatrics will be held in Rome.

THE twenty-fourth annual meeting of the French Hygiene Congress will be held on October 18 and 19 in the Pasteur Institute, Paris. The president this year is Dr. Lesné, a pediatrician. The subjects selected for special discussion are: (1) overworked school children from the medical, social and administrative points of view, (2) prophylaxis of tuberculosis in schools, (3) backward children in city schools and (4) healthful milk. Those who wish to take part in the program may write to Dr. R. Dujarric de la Rivière, 28 rue du Docteur-Roux, Paris (15).

THE quarterly meeting of the Grand Council of the British Empire Cancer Campaign was held on July 12. *Nature* states that on the recommendation of the Scientific Advisory Committee, the following grants were approved: £500 to Dr. P. M. F. Bishop, at Guy's Hospital, for the expenses for one year of certain investigations in regard to endocrine therapy in relation to cancer; £250 to Professor G. I. Finch, at the Imperial College of Science and Technology, for the expenses of an investigation, on behalf of the Scientific Advisory Committee, into the nature and structure of carcinogenic compounds; and £160 to Dr. P. R. Peacock, at the Glasgow Royal Cancer Hospital, for the purchase of special apparatus for the continuation of his cancer research. On the recommendation of the Joint Committee of the Campaign and of Mount Vernon Hospital, Dr. G. Cranston Fairchild was reappointed the William Morris research fellow in radiology at that hospital for a further period of one year. The William Morris research fellowship was established five years ago by a donation of £25,000 by Lord Nuffield.

DISCUSSION

A NEW HOUSEHOLD PALM, NEANTHE BELLA

A GRACEFUL diminutive palm discovered in eastern Guatemala in 1902 has proved well adapted to household cultivation, flowering and seeding freely under living-room conditions, enriching domestic life. Millions of people in all civilized countries are devoted to the care of house plants, finding solace in an indoor exercise of the gardening instinct that opened to our remote ancestors the course of human progress. Palms have special attractions of form and sentiment, though most of the tropical species are difficult to domesticate and rarely reach the fruiting stage, even in large conservatories.

The name Neanthe means youthful-flowering, alluding to inflorescences often appearing on plants only two or three years old, and to a like precocity of the early seedling leaves, in having the same pinnate form as the leaves of older plants. Most kinds of palms have simple grass-like leaves at first, and several years may elapse before the palm-like "character-leaves" appear that render the plants attractive. The successive leaf-forms are supposed to recapitulate the course of plant evolution, like the embryonic characters of animals. The historic Chamaerops palm at Padua drew Goethe's attention in September, 1786, to the basic concept of morphology and evolution, "the original identity of all of the parts of plants."

Suppression of the preliminary leaf-forms greatly facilitates the use of Neanthe as a household palm; even the young plants only a few inches high having a notable grace and beauty that warrant the name *bella*, rendered by Valpy as "pretty, charming, fine, neat, nice." Other "dwarf" palms are known, some

lacking upright trunks or producing only simple leaves, but Neanthe has retained in miniature proportions the form of a slender tree-palm with a spreading crown of foliage, the leaf-blades and inflorescences usually less than a foot long, the trunk only half an inch thick, and the roots accommodated in a 5-inch pot, or even 4-inch, if set in a jar or double-potted for table or office use.

The wild palms grew in rather low open forests near the summits of precipitous limestone mountains, at altitudes around 3,000 feet, in the Department of Alta Vera Paz, between Senaju and Cajabon, a coffee-growing district of great natural beauty sparsely inhabited by the Kekchi people, one of the primitive Mayan tribes. The rainfall is heavy, but the steeper slopes have only a thin layer of humus, so that even short periods of dry weather induce stress conditions in the undergrowth, a habitat for developing the two particular adaptations of a household plant, tolerance of shade and tolerance of drought. The palm extends to lower altitudes and longer dry seasons in the adjacent Department of Peten, including the forest-covered sites of the ancient Maya cities of Tikal and Uaxactun.

A few of the small palms were carried home from Alta Vera Paz by the simple expedient of wrapping the roots in a little of the forest leaf-mold and rolling the entire plant in an open funnel of waxed paper. Several weeks of travel were survived and nearly 30 years in a Maryland farm home, where temperatures in winter nights often were low, but the palms continued to thrive, with only the usual care of potted plants. Flowers appeared every year, but the sexes separate as in the date palm, and no seeds developed until hand-pollination was begun in May, 1927. Eventually the original palms were placed in a greenhouse to facilitate the production of seeds, and are still vigorous, with trunks three to five feet long, showing 60 to 80 joints. An adult palm develops three or four inflorescences every year, with globular pale yellow flowers in an alternating two-ranked arrangement along the slender simple branches.

Pollination is simplified by placing several male flowers in a small dish and removing the corollas, thus exposing the dark anther cells, with the pollen escaping as a white dust. The grains adhere readily to a fine brush or shred of cotton, for lightly touching the female flowers. The fruits swell in a few days, but take nearly a year to ripen, eventually turning dark purple, and the inflorescence orange-yellow. A hundred seeds or more may be produced on a single inflorescence, and germinate in three to six months.

The flowering period extends through several weeks, but each inflorescence is in functional condition for only two or three days. Household propagation is practicable, but several palms should be accessible, as in neighborhood groups of plant lovers, for pollen to be available when required. Also in high schools and colleges Neanthe may be propagated for educational use. No other member of the entire group of palms affords similar opportunities for observing the floral specialization of the two sexes, following the processes of reproduction and development, or determining the inheritance of variations in foliage and other characters.

The floral specializations of Neanthe include a carneous monopetalous corolla in both sexes, valvate lobes and a narrow triangular aperture occupied in the male flower by a green peltate pistillode, much larger than the functional pistil concealed in the female flower, so that the sexes have been confused. A central depression of the pistillode often secretes a spherical drop of nectar, glistening in the sunlight. An osseous endocarp enclosing the spherical seed is another diagnostic feature. Foliar specializations may be seen in the open, overlapping leaf-sheaths, laterally compressed petioles and evenly tapering single-veined pinnae, usually 14 or 15 on each side of the rachis, in the type species.

Neanthe belongs to a group of small palms, the Chamaedorea family, though remote from the type of the genus Chamaedorea, a palm from Venezuela first described and illustrated by Jacquin in 1797 as *Borassus pinnatifrons,* with broad many-veined pinnae, the male petals separating near the base but connate at the apex, the female petals imbricate and the stigmas emergent. A genus Collinia was proposed by Liebmann in 1845 for *Chamaedorea elegans,* overlooking a Collinia suggested by Rafinesque in 1819 for a plant of the borage family, and also Collania in the amaryllis family. Liebmann gave no generic description, and that supplied by Oersted in 1858 had reference to drawings of floral structure published by Nees von Esenbeck in 1834 from conservatory plants with golden-yellow flowers and a stout cylindric pistillode, unlike the household palm, which also was considered at first as a form of *Chamaedorea elegans.*

The original *Chamaedorea elegans,* named by Martius in 1830 from the district of Vera Cruz, was a much larger palm, the trunk three times as thick, the leaves nearly 4 feet long, the pinnae attaining 20 on a side, a foot long and nearly an inch wide. A leaf of such proportions, collected by Liebmann near Jalapa in March, 1841, has come to the U. S. National Herbarium from the Copenhagen Museum. The palm figured as *Chamaedorea elegans* in Curtis's *Botanical Magazine,* 1855, plate 4848, belongs to a different group, but plate 7959, published in 1904 as *Chamaedorea pulchella,* may be close to the original *elegans.*

A specimen in the U. S. National Herbarium collected on April 7, 1902, near Sepacuité has been designated as the type of *Neanthe bella.* The forms of the pistillodes eventually may characterize different genera, but two other species may be referred provisionally:

Neanthe elegans (Martius), the larger palm that Martius described, with a three-angled pistillode, and *Neanthe neesiana,* to serve as a specific name for the golden-flowered palm figured by Nees and cited by Oersted, with the pistillode nearly cylindric and the stigmatic rim very narrow.

O. F. COOK

BUREAU OF PLANT INDUSTRY
U. S. DEPARTMENT OF AGRICULTURE

"RACES" AND "HOMING" OF PACIFIC SALMON

IN a recent communication Professor A. G. Huntsman[1] objects to my[2] use of the word "races" in referring to the local populations of Pacific salmon, on the ground that the genetic character of the observed differences in local populations is not proved, and he infers that without this proof my argument that the Pacific salmon show a homing reaction is invalidated.

As to the first point: The word "race" is used, and properly, in referring to local populations that are distinguishable, regardless of whether the differences are genetic or environmental. O. E. D. gives as one definition, "A group or class of persons, animals, or things, having some common feature or features." In dealing with the salmon of the Pacific Coast many of us have been accustomed to use the word in this sense and without implications as to the nature of the differences. While I believe that many of these differences are genetic I concede that the rigid experimental proof is lacking; but I think that the point is not relevant to the discussion of "homing."

As to the second point: My argument does not at all require that the observed differences in the local populations be genetic. If these local populations (or races) are distinguishable it does not matter whether the differences are genetic, the result of environmental influences during the early life in fresh water or the later life at sea or are artificial. If large numbers of the Pacific salmon travel beyond the "zone of river influence" and if the fish after distribution into their spawning streams show significant differences, whether the differences be genetic or not, "the simplest theory that will adequately explain . . . these facts is that the salmon do return predominantly to their home streams."

WILLIS H. RICH

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THE FISH BOWL AS A FIRE HAZARD

THE recent note by Julian H. Lewis,[1] "A Possible Source of Laboratory Fires," recalls an experience in our laboratory early this spring.

Smoke was discovered coming from the unpainted woodwork back of the large bottle in which our distilled water is collected. The sun was shining directly on the bottle and the woodwork in question is but an inch or so removed from the back of the bottle, which has a diameter of about 18 inches and is roughly spherical in shape. Examination of the woodwork showed a number of rather deeply charred lines where the late afternoon sun's image formed by the bottle had burned its way along the wood. The lines were short, for it happens that the sun can shine directly on this bottle for but about an hour on any one day. We soon discovered further that the period of daily exposure of the bottle to the sun's rays was but a few weeks in length, in spring and again in fall. This burning has presumably been going on for about ten years.

It seemed at first odd to us that enough heat from the sun should be transmitted through the water to start combustion. Our intuition is probably due to the common use of a water cell to filter out the longer waves in a projection lantern in order to avoid overheating the slide. Inquiry to insurance companies brought out the fact that fires are occasionally caused by the "burning glass" action of the familiar fish bowl. Also the following brief consideration of the fundamental principles involved shows that the goldfish bowl in the direct sunshine should be regarded as a real fire hazard.

As may be found in standard text-books, the transmission data for water as a function of the wave-length of the radiation incident upon it shows great absorption for the longer wave-lengths. This absorption is just noticeable at the red end of the visible spectrum, the transmission falling to about 50 per cent. at 1,000 m μ and about 20 per cent. at 1,200 m μ.

Solar radiation arriving at the earth's surface has its peak power at about 500 m μ and falls to about 10 per cent. of this value at 1,200 m μ and 1 per cent. at 2,000 m μ. Thus, due to the sun's high temperature, its radiated power has its maximum in the visible region of the spectrum. Practically all the sun's heating effect is in and near the visible spectrum, namely, in the wave-length range which is transmitted by water.

The incandescent lamp, on the other hand, which is used as a light source for the projection lantern has a filament temperature but little over 3,000° K, as a consequence of which the peak of its radiation characteristic comes around 1,000 m μ. It has scarcely started to fall from this peak at 1,200 m μ and has roughly 70 per cent. of its total radiated energy in those wavelengths which are longer than those transmitted by water.

Thus, for a tungsten filament lamp source, about two thirds of the radiated energy may be absorbed in a

[1] SCIENCE, 85: 582–583.
[2] SCIENCE, 85: 477–478.
[1] SCIENCE, 85: 605, June 25, 1937.

water cell which would absorb but a very small fraction of the power of the sun's rays. In fact, a comparison of the transmission curves of water and of glass and of the radiation curves of bodies of the sun's temperature and those of incandescent filament temperatures show that water is almost as good a transmitting medium for the sun's radiation as is glass for the radiation of an incandescent filament.

The effect here being commented upon is in no sense a new one though we have seen no direct statement of the marked difference in behavior of glass and water to solar and incandescent lamp radiation. This subject is one, however, which might well receive some attention, even in elementary physics courses.

Karl S. Van Dyke

Wesleyan University

A POSSIBLE SOURCE OF LABORATORY FIRES

The article by Julian H. Lewis under the above title in No. 2217 of Science reminds me of my own experience. Many years ago I was engaged in study of numerous petrographical slides and very often worked evenings by the artificial light of a kerosene lamp. With the purpose of whitening that light I used a glass ball about six inches in diameter filled with ammoniacal solution of copper sulfate. During the daytime this ball was always removed to the sill of the window in front of which stood my table. One bright day when I was busy with my microscoping I noticed a thin spray of smoke rising from the sill. Investigating the matter, I found that this was not the first occurrence because all the front side of the table above the sill was covered with charred lines burned out by the sun rays passing through the ball referred to. The danger of fire was not great in this case, because the ball was close to the window and the sun burned out thin lines, not concentrating the heating on a limited surface. But, anyhow, after that discovery, in the daytime the ball was kept under the table, and thereafter I was very careful not to leave any kind of bottle near the windows where those bottles could be hit by the direct sunlight.

I. P. Tolmachoff

Carnegie Museum
Pittsburgh, Pa.

SCIENTIFIC BOOKS

SOME RECENT BOOKS IN THE PLANT SCIENCES

Pollen Grains. By R. P. Wodehouse. xv + 574 pp. 123 figs. 14 plates. McGraw-Hill Book Company, New York. 1935. $6.00.

A century has passed since two great men of science, von Mohl and Fritsche, were each apparently so impressed by the other's study of pollen structure that both sought fresh fields of endeavor. It remained for Hugo Fischer, in 1890, to lay the foundation of modern comparative pollen morphology. And since his time the topic has lain largely dormant until stimulated by the current interest in allergy and pollen analysis.

The work under review is that of a master. It is the result of industry, skill and cerebration of an unusual order, and was carried to completion in the scant leisure of a busy industrial life. In the measured opinion of the reviewer, it represents one of the notable achievements of American botany. To the clinician and the micropaleobotanist it is an indispensable handbook; to the student of phylogeny and morphogenesis it opens up new opportunities.

The book is divided into two main sections: (1) a general portion dealing with history and practical procedures and ending with a discussion of structural characteristics; (2) a taxonomic portion in which is figured, described and compared representative pollen of all the orders of gymnosperms and some thirty families of angiosperms.

The historical section supplies information not familiar to many modern botanists and is all the more valuable because so many of the original sources are now difficult to obtain.

The practical discussion is first-hand stuff. The author's own professional work, of course, deals with hay-fever and other allergic problems whose relation to pollen he presents. He has also had direct experience with the subject of pollen microfossils in his study of the Green River shales and his pollen analyses of peat from the Himalayas; but the valuable chapter dealing with pollen analysis has been contributed by Gunnar Erdtman, of Stockholm. This chapter discusses the limitations of technique as well as its procedures and should be read by every worker in the difficult, involved field of North American pollen analysis.

Probably Wodehouse's greatest contribution is in the field of pollen geometry and is based upon the spatial relations inherent in the tetrad pattern—the trischizoclastic system, as he calls it. This is set forth in his discussion of structural characters at the end of Section I and is, of course, documented in detail in Section II, dealing with taxonomy.

In the latter section his underlying evolutionary idea is the primitive character of wind pollination, its subsequent modification into insect carriage and the reappearance of wind pollination in many entomophilous groups of flowering plants. This is quite in keeping with current phylogenetic thought. Noteworthy fea-

tures are the establishment of homologies within the gymnosperms and between that group and the primitive angiosperms; also the brilliant discussion of the Compositae.

On the basis of pollen character, the author considers the Magnoliaceae to be primitive; that is one of his few exceptions to the Engler-Prantl phylogeny. And since convention demands that a reviewer sign off with some unpleasant testament of his good faith, this gives me an excuse to ask why in thunder the pollen of the Salicales and Amentiferae should be considered more primitive than that of the Rosales.

Most appropriately, the book is dedicated to R. A. Harper.

PAUL B. SEARS

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Production of Field Crops. By T. B. HUTCHESON, T. K. WOLFE and M. S. KIPPS. xvii + 445 pp. 110 figs. McGraw-Hill Book Company, New York. 1936. $3.50.

THE first edition of "Production of Field Crops," which appeared in 1923, followed the outline for a "standard introductory course in field crops," as adopted by the American Society of Agronomy. This outline was developed to present the fundamental underlying principles of crop production before dealing with individual crops. The object was to avoid repetition of such knowledge that is common to all crops, as choice of good seed, seedbed preparation, germination and growth, tillage, fertilization and harvesting and storage. The authors were very successful in the first edition, as indicated by the favorable reception given it by colleges and schools throughout the country.

In the second edition the same general plan of organization is followed. The first section, which includes 19 chapters, deals with general information pertaining to production of all crops; the next section of 7 chapters discusses cereal or grain crops, while a section of 3 chapters is given over to legumes for seed, and another of 3 chapters to forage crops. Sections of 2 chapters each on root crops and fiber crops follow. The last 3 sections, each of 1 chapter, deal with tubers, sugar plants and stimulants.

The book is unique in that it sets forth in broad general outlines the fundamental facts underlying the production of crops. The size of the text has been reduced without material injury to its scope so as to better meet the needs of a one-semester course. This has been brought about by a reduction in illustrative tables rather than subject-matter.

At the end of each chapter a list of thought-provoking questions has been added. These are designed to stimulate outside reading.

The second edition has been revised to include important new knowledge which has accumulated during the past thirteen years.

The authors have continued the excellent use of maps showing regional distribution of crops, making it possible to emphasize crop ecology. A limited number of charts and drawings have been used to advantage. The book is illustrated with well-chosen photographs which in the main show characteristics of individual crops. The second edition is more of a text-book and less a reference book than the first. We believe it will serve a wide purpose in advancing an understanding of the fundamental problem in crop production.

A third author—M. S. Kipps—has collaborated with Hutcheson and Wolfe in the preparation of the second edition.

W. L. BURLISON
J. J. PIEPER

UNIVERSITY OF ILLINOIS

Growth Hormones in Plants. Authorized English translation of *Die Wuchsstofftheorie und ihre Bedeutung für die Analyse des Wachstums und der Wachstumsbewegungen der Pflanzen.* By P. BOYSEN JENSEN. Translated and revised by GEORGE S. AVERY, JR., and PAUL R. BURKHOLDER, with the collaboration of HARRIET B. CREIGHTON and BEATRICE A. SCHEER. xiv + 268 pp. 64 figs. McGraw-Hill Book Company, New York. 1936. $3.50.

THIS book represents a reworking of the subject rather than a direct translation of the German. The text has been expanded and the subject brought up to date by the inclusion of much recent work.

The text-figures have been increased from twenty-six to sixty-four, greatly augmenting the interest of the text thereby. Noteworthy are several full-page figures which present in pictorial form such subjects as an historical outline of early discoveries concerning plant hormones, an outline of recent contributions to our knowledge of plant growth hormones, the *Avena* coleoptile technique for testing growth hormone content, etc.

In addition to the citations in the original, the revision presents nearly 200 new titles, which deal directly with plant hormones, and a useful bibliography of more than 100 titles of works (not discussed in the text) which pertain to other hormones and similar substances affecting plant growth (animal hormones, biox, vitamins, etc.).

A historical account of the development of the subject from Darwin down to the present occupies the first chapter. The second chapter is devoted to the techniques for the detection and quantitative determination of growth substances. A third chapter presents the methods of preparation of growth substances from plant and animal sources, the structural constitution of the auxins, the physical and chemical characteristics

of the auxins prepared from plant materials, and the physiological properties of the auxins, their derivatives and other compounds. The occurrence and formation of growth substances in plants and animals are treated in a fourth chapter.

Other chapters deal with the transport of growth hormones and their significance for normal plant growth, bud development, tumor formation, phototropism, geotropism, traumatropism and thigmotropism.

The addition of a summary at the end of each chapter and a good index increase the usefulness of the work.

As the first comprehensive review in English of the literature of plant growth hormones, this book will be of immense value not only to American botanists but to scientists in general who are interested in the subject but have been unable to read its extensive and scattered literature.

Carl D. LaRue

University of Michigan

Flora of Jamaica. By William F. Fawcett and Alfred Barton Rendle. Vol. VII, Dicotyledons, Part V. By Spencer Le Marchant Moore and Alfred Barton Rendle. ix + 303 pp. 100 figs. The British Museum (Natural History), London. 1936. 15/

Students of the West Indian flora have long awaited the publication of Volume VII, Part V, of Fawcett and Rendle's "Flora of Jamaica" as a guide to the identity and distribution of the epigynous Sympetalae of that island, which by reason of its location is an important point in working out the tropical North American flora. The work, as was expected, follows along the same lines as the previously issued volumes in its conservative tendencies as to generic aggregates. As in the case of the other volumes, the illustrations are excellent and the key-characters clearly defined. It is with regret that we note the Lobeliaceae still included in the Campanulaceae when there are such clearly distinguishing characters for the two families. It should be noted that the majority of the Rubiaceae and all the Compositae are the work of the late Spencer Moore, and the families Caprifoliaceae, Campanulaceae and Goodeniaceae and six small genera of the Rubiaceae are the work of Dr. Rendle.

E. J. Alexander

The New York Botanical Garden

Methods in Plant Physiology; A Laboratory Manual and Research Handbook. By Walter E. Loomis and Charles A. Shull. xviii + 472 pp. 94 figs. McGraw-Hill Book Company, New York. 1937. $4.50.

This book meets in an excellent way the long-standing demand for a single text to present in an organized way the customary experimental approaches to plant physiology and the essential analytical techniques of routine investigations, information which students have hitherto been obliged to garner from widely scattered sources.

The book comprises twenty-three chapters and a comprehensive tabular appendix. The first thirteen chapters contain the directions for a well-organized series of laboratory experiments on water relations, nutrition, photosynthesis, translocation, respiration, growth and movement. Directions are accompanied by brief but lucid explanations of purposes underlying experimental operations. Each experiment is supplemented with a few highly objective questions and citations to related literature.

The authors have included several experimental procedures not found in ordinary laboratory manuals. Worthy of mention especially are Heinicke's flowmeter method of gas analysis, the use of Guthrie's color standard in Schertz's quantitative estimation of chlorophyll, a unique technique for study of the "dark phase" reaction of photosynthesis, and a generous list of useful micro-chemical tests on tissue sections. The use of trees in studies of nutrition and translocation reflects the desire to make the experiments of use to students of horticulture as well as to avoid the numerous pitfalls of immediate response to physiology.

Chapters 14 to 22 of the manual contain directions for the more common chemical, physical and statistical analyses employed by plant physiologists. Especially well treated are the chemical procedures for ash, nitrogen and lipid determinations. Extremely useful techniques for quantitative studies of osmotic pressure, surface tension and specific conductivity are given along with explanations of the principles involved in the usual types of apparatus employed. The last chapter, by Professor George W. Snedecor, presents an excellent survey and mathematical treatment of bio-statistics as these relate to the validity of experimental data and their interpretation. The text concludes with a most useful appendix of thirty-three ready reference tables of physical, chemical and mathematical constants commonly required for analytical work.

It is evident that the manifold objectives of this book represent a new departure in college texts. The economy of time and effort in having a plant physiology laboratory manual, a quantitative physico-chemical analysis, a bio-statistical handbook and ready reference tables of physical constants between the covers of one book will definitely assure its wide-spread use and thereby justify the originality of the authors as well as recompense the publishers for their courage in under-

taking the sale of something really new in the way of botany text-books. Though originally intended primarily as a reference text, its general usefulness will without doubt lead to its adoption as a text in colleges and universities. The authors have employed a succinct yet animated and lucid style of writing.

WALTER F. LOEHWING
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SPECIAL ARTICLES

TUMOR PRODUCTION BY HORMONES FROM PHYTOMONAS TUMEFACIENS[1]

Phytomonas tumefaciens (Smith and Town.) Bergey *et al.*, incitant of crown-gall, was grown in a medium containing 2 per cent. dextrose and 0.1 per cent. bacto-tryptophane in distilled water, and in a medium containing, in addition, 1.0 per cent. bacto-peptone. Lacking salts, these media are simpler than those used by Brown and Gardner.[2] Cultures 2 to 4 days, three and twelve weeks old, also pellicles formed in the latter medium, were extracted with anhydrous peroxide-free ether, yielding crude waxy preparations. The most active extract was obtained from the former medium and organisms cultured twelve weeks. It was applied without wounding to hypocotyls of the red kidney bean (*Phaseolus vulgaris*) prior to straightening. For comparison, applications of 3 per cent. heteroauxin in anhydrous lanolin also were made in dosages of 0.005 cc and 0.01 cc with a tuberculin syringe. The dosages of bacterial extract were estimated at 0.0025 cc.

Control plants wounded by needle pricking, incision with or without insertion of mica or coverglasses, and complete transection of actively growing hypocotyls were set up to determine effects of moderate and severe wounding. Control inoculations with *P. tumefaciens*, with ether extracts of uninoculated media and with lanolin also were made.

Bacterial extracts applied unilaterally produced negative bending of 60° or less in from one to two hours. In three to four hours clearing appeared at the site of application, at and below which the hypocotyl first thickened down to soil level and later along all radii, though most abundantly at and below the site of application. Within eighteen hours thickening also extended a short distance upward. Temporary injury was evident in retarded straightening of the arch, elongation of the hypocotyl and development of the epicotyl. Later these general pathic effects were overcome. Whitish tumors appeared beneath and adjacent to the applications. In from three to four days local swellings marked sites of adventitious roots. Similar but more pronounced effects were produced with the heteroauxin-lanolin mixture. The dosages of 0.005 cc produced as marked early results as 0.01 cc dosages, but later effects were weaker. *P. tumefaciens* produced very small galls, the changes being less rapid than those effected by the extract and heteroauxin and the tissue firmer. Application of ether extracts of non-inoculated media and of lanolin gave negative results. Needle pricks caused slight local callus formation. Incisions, especially blocked ones, caused more wound tissue, especially above the incision and, at times, adventitious roots. The basal ends of severed hypocotyls swelled in from two to three days into massive calluses and later developed vigorous roots. The wound responses resembled those produced by extract and heteroauxin applications in intact hypocotyls but were less intense and better integrated than those incited by the latter.

The tumors produced by heteroauxin and bacterial extracts were initiated by cell enlargement, followed by cell division. Cell enlargement often was so excessive that adjoining cells in the cortex separated, forming cavities. These internal wounds led to development of loose callus. In addition or when cavities did not develop, cortical cells, including the endodermis, divided. The latter often was involved in development of extrafascicular vascular tissues[3,4] and roots. The vascular tissues, rays and pith also were activated.

Since transection, incision or application of heteroauxin or of bacterial extracts lead to similar effects in the hypocotyl, one may formulate the hypothesis that disturbance of the usual auxone concentration of the affected tissues is one of the causes of cell enlargement characterizing these effects. This disturbance, possibly a hyperauxony, gives hypocotyledonary cells opportunities to realize potentialities of cell enlargement, division and differentiation not stimulated to or inhibited from expression in the course of normal development.

In crown-gall formation this auxone disturbance probably is not a brief but a prolonged condition because the parasite not only produces heteroauxones and disturbs host correlations but also starts new abnormal growing centers, creating additional sites of autoauxone production. Growth substances obtained from *P. tumefaciens* produce effects similar to those of heteroauxin in the bean hypocotyl, but it can not be stated as yet that they are any of the known auxones.[5]

[1] Supported in part by a grant from the Rockefeller Foundation to the University of Chicago.

[2] N. Brown and F. E. Gardner, *Phytopathology*, 26: 708–733, 1936.

[3] K. Schilberszky, *Ber. d. Bot. Ges.*, 10: 424, 1892.

[4] E. J. Kraus, N. Brown and K. C. Hamner, *Bot. Gaz.*, 98: 370–421, 1936.

[5] After this article was submitted, a new lot of extract made possible application of the hydrochloric acid, ferric

Since heteroauxones produced by non-gall-forming organisms incite tumors in plants not parasitized by these organisms and since wounding alone leads to tumor production, it appears that gall production by a particular parasite in a particular host is initially conditioned by factors determining specificities of parasitism.

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SALT ACCUMULATION AND POLAR TRANSPORT OF PLANT HORMONES[1]

It is a well-established fact that a number of ions may be taken up by plant cells against a concentration gradient, or in other words that many cells are able to perform concentration work. The physico-chemical processes responsible for this concentration work are not generally understood, but the experiments have shown that the energy is ultimately furnished by oxygen respiration, in the absence of which no ion accumulation is possible. If the internal concentration of a given ion is plotted against its concentration in the surrounding medium, a more or less logarithmic relationship is obtained. In order to compare the accumulation process with polar hormone transport, it is advantageous to formulate the former as follows: Accumulation consists in the uptake of ions by the cell to such an extent that upon reaching the steady state the internal concentration is increased above that of the surrounding medium by a definite *amount*. At very low external ion concentrations the equilibrium concentration inside (steady state) may not be reached within the experimental period, which would then account for the initial parabolic rise in the accumulation curve. But from the data of Hoagland and Davis, and Collander for Nitella, and of Steward for potato tuber cells it is evident that for each set of conditions (temperature, rate of respiration, sugar content of cells) there is a constant increment independent of outside concentration. This means that for one given set of conditions the internal ion concentration may be calculated from the external concentration plus a certain amount. Thus the accumulation mechanism is able to raise the internal concentration to a given height above its surroundings. This makes it clear why no constant "accumulation ratio" is found.

The polar transport of auxin in the living plant behaves in a similar way. It may be defined as the concentration of auxin (an organic acid) from apex towards base of each cell. It does not seem that there are theoretical objections against suggesting a homology between concentration from outside towards inside and concentration from apex to base of a cell. In addition, the facts are in accordance with this view. The accompanying graph shows the amount of indole-3-acetic acid transported in two hours through Avena coleoptile sections (4.2 mm long), as a function of the original concentration applied to one end of the sections. It will be seen that the amount transported from apex to base (normal transport) increases almost linearly with the logarithm of the applied indole acetic acid concentration. Beyond 1 mg/cc the amount transported decreases, probably due to toxicity, proving that the observed values are not caused by "leakage" through vessels or along the surfaces of the sections. The curve for transport from base to apex (inverse transport) is exactly like the normal transport, except that the applied concentrations must be 100 times as high to give numerically the same transport. This means that at each given concentration a certain amount *more* of indole acetic acid is transported in the normal direction than is transported in the inverse direction or, in other words, that the polar auxin transport mechanism handles a constant amount of indole acetic acid independent of the existing gradient. This is in direct parallelism with ion accumulation, in which also a given amount more of ions are moved from outside towards inside of cell than are moved in the reverse direction, independent of the external concentration.

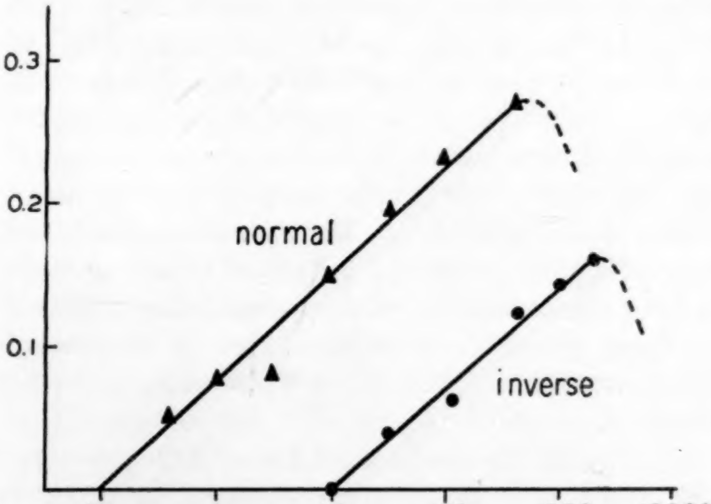

Fig. 1. Amount of indole-3-acetic acid (ordinate) transported in 2 hours through 6 Avena coleoptile sections, from apex towards base (normal) and from base towards apex (inverse), as a function of the applied concentration in mg per l (abscissa).

In addition it might be mentioned that the fact that the auxin concentration must be 100 times higher at the base than at the apex to get equal amounts trans-

chloride, amyl alcohol test. The color reaction characteristic of β-indoleacetic acid (heteroauxin) was obtained, indicating that this substance or a closely related indole compound is the heteroauxone produced by *P. tumefaciens*. We are indebted to our colleague, Professor F. C. Koch, of the department of biochemistry, for advising us and checking these tests.

[1] Published as a report on Work Project No. 6062, Official Project No. 65-3-5380, conducted under the auspices of the Works Progress Administration.

ported agrees very well with what is known about the effect of auxin on root formation. The induction of roots on cuttings by basal application of indole acetic acid requires at least 100 times higher concentration than does apical application.

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THE GREEN MUSCARDINE FUNGUS ON THE PERIODICAL CICADA

IN connection with special work by the senior writer in the Department of Entomology, University of Maryland, on the periodical cicada, *Magicicada septendecim* (L.), it is of especial interest to note that the green muscardine fungus (*Metarrhizium anisopliae* (Metsch.) Sorokin) was found on this insect in the spring of 1936.

On May 22, 1936, Mrs. P. W. Wetmore, Takoma Park, Md., brought to the senior writer two live nymphs of the periodical cicada, both of which proved to be attacked by a fungus. The nymphs were sluggish and had failed to molt. Otherwise they appeared normal with no evidence of infection. When examined microscopically, however, abundant mycelium of a fungus with septate mycelium was found in them. Later, other similar specimens were collected on the ground from the same location. Four dead nymphs also were found in the tunnels. These latter were covered with fairly abundant creamy-white mycelium. This mycelium was transferred to potato-dextrose agar and to nutrient beef agar on which the fungus grew readily and subsequently sporulated abundantly. It also sporulated readily on rice kernels. The fungus on diseased nymphs placed in Petri dish moistchambers also sporulated abundantly in 5 to 19 days. The sporulating fungus was olive-green in color. From the microscopical characters of the spores and sporophores from these various sources, it was evident that the fungus was *Metarrhizium anisopliae* (Metsch.) Sorokin. The spores measured 1.8–4.5 $\times$ 7.8–12.8 μ, chiefly 3–3.8 $\times$ 9.7–11.3 μ. On the basis of these measurements, apparently the fungus is the long-spored form referred to by Delacroix,[1] Friederichs[2] and Johnston,[3] and named *f. major* by Johnston.

Apparently the short-spored form of *M. anisopliae* was found in Java on large singing cicadas by v. Höhnel,[4] who described the fungus as a distinct species, *Penicillium cicadinum*. Petch[5] transferred this species to the genus *Metarrhizium*, making the combination *M. cicadinum* (v. Höhnel) Petch. However, Petch, who also gives a literature summary, prefers to consider *M. cicadinum* as a synonym of *M. anisopliae*. This view seems tenable. The Java fungus, however, apparently represents the short-spored form of *M. anisopliae*, as its spores are described as 1.5–2 $\times$ 5–6 μ, rarely 7 μ.

Healthy nymphs and healthy adults were artificially inoculated with spores from the pure cultures of *M. anisopliae* kept in moist Erlenmeyer flasks, and both nymphs and adults became diseased, the nymphs being more susceptible than the adults. The fungus was readily reisolated. However, the fungus did not sporulate on the adults. Later, newly hatched nymphs also were inoculated in Petri dishes and these young nymphs proved to be unusually susceptible.

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1 G. Delacroix, *Bull. Soc. Myc. France*, 9: 260–268, 1893.
2 K. Friederichs, *Centbl. Bakt.* [etc.], Bd. 50, Abt. 2, (13/19): 335–356, 1920.
3 J. R. Johnston, *Puerto Rico Bd. Commrs. Agr. Bul.* 10, 33 pp., 1915.
4 F. v. Höhnel, *Sitzber. Akad. Wiss. Wien*, Math. Naturw. Kl. Bd. 118, Abt. 1: (1–178 in reprint), 1909.
5 T. Petch, *Brit. Mycol. Soc. Trans.*, 16: 55–75, 1931.

THE EFFECT OF REPEATED CORTIN INJECTIONS UPON RENAL EXCRETION IN THE NORMAL ORGANISM[1]

IT has been reported[2] that large amounts of cortin produce a differential effect upon the excretion of electrolytes in normal human beings. A further study of these effects has been made in normal dogs.

Normal adult female dogs were fed a constant diet consisting of a mixture of beef heart, Purina chow and 2 g of NaCl daily. The dogs were fed at the same time every day, which was nine hours before the beginning of the test period. They were allowed as much water as they desired, except on the test days. During the tests the dogs were kept in metabolism cages and at three-hour intervals were catheterized and given 100

TABLE I

RENAL EXCRETION IN A DOG DURING THE FIRST SIX HOURS FOLLOWING THE INTRAVENOUS INJECTION OF CORTIN*

Date	Injection	*Vol.* cc	*Na* m. Eq.	*Cl* m. Eq.	*K* m. Eq.
1–21–37	Control	194	10.17	12.57	4.34
1–23–37	Control	184	6.18	9.39	3.95
1–25–37	Cortin	**130**	**1.24**	**4.83**	**6.25**
1–27–37	Cortin	**90**	**3.84**	**6.45**	**6.82**
1–29–37	Control	256	10.18	15.28	4.92
2– 3–37	Cortin	**132**	**5.67**	**9.87**	**7.22**
2– 5–37	Control	172	7.72	11.59	5.05
2–15–37	Cortin	**222**	**7.15**	**13.42**	**6.22**
2–26–37	Control	206	9.66	9.38	6.04
3– 4–37	Control	147	8.37	12.40	6.35
3– 9–37	Cortin	**243**	**13.46**	**18.52**	**6.07**

* Heavy-faced type, after cortin; light faced type, control. (20 cat units in 0.5 cc.)

1 From the department of physiology, the Ohio State University, Columbus. Aided by a grant from the Rockefeller Foundation.
2 G. W. Thorn, Helen R. Garbutt, F. A. Hitchcock and F. A. Hartman, *Proc. Exp. Biol. and Med.*, 35: 247, 1936.

cc of water by stomach tube. The maximum change in electrolyte excretion following cortin injection occurred during the first six hours. Initial injections of cortin (20 cat units) into eight normal dogs produced marked reduction in the sodium and chloride excretion and usually an increased excretion of potassium. The initial response of the different dogs to the same amount of cortin was essentially the same.

Four dogs have been injected repeatedly. With each succeeding injection the response has become smaller until it has entirely disappeared. Table I is typical of the four animals. Two human beings have shown a similar response to repeated cortin injections.

FRANK A. HARTMAN
LENA LEWIS
GWENDOLINE TOBY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A PLEURAL CANNULA[1]

THE recording of respiration in animal experiments is frequently a source of difficulty to the student and annoyance to the staff. The more accurate methods are beset with so many technical difficulties that either the student fails to obtain a record or the apparatus may be so expensive that the school fails to provide it. In an attempt to simplify our animal experimental methods, we have used many devices for graphically recording respiration. The pleural cannula method seemed to be the most simple, even though it involved a slight amount of surgical procedure, *i.e.,* a short slit in the skin between two ribs, a sharp thrust of the cannula so that the open end lies in the pleural cavity. The outer end of the cannula is connected with a recording tambour, giving essentially a record of variations in intrathoracic pressure during respiration. The most annoying difficulty with this method is the ease with which the cannula is displaced, thereby upsetting the record or requiring re-introduction when the cannula is completely pulled out. This unfortunate accident seems most likely to occur at the most critical moments of an experiment.

The principle of recording respiration by the pleural cannula method seemed sound and very easy to apply. The only difficulty is the instability of the cannula itself. A careless finger catching the rubber tube leading to the tambour resulted in the sudden withdrawal of the cannula; or even the accidental dropping of a light instrument on the rubber tubing may cause the cannula to slip out. It was felt that if we could overcome this difficulty of instability in this method, we would have an easily recording mechanism for respiration.

With this idea in mind, we developed the pleural cannula herein described. Instead of using the ordinary flattened and tapering point on the pleural cannula, we capped the point with a two-pointed barb which was somewhat flattened and pierced with four holes. Fig. 1 is a drawing of the cannula. One of

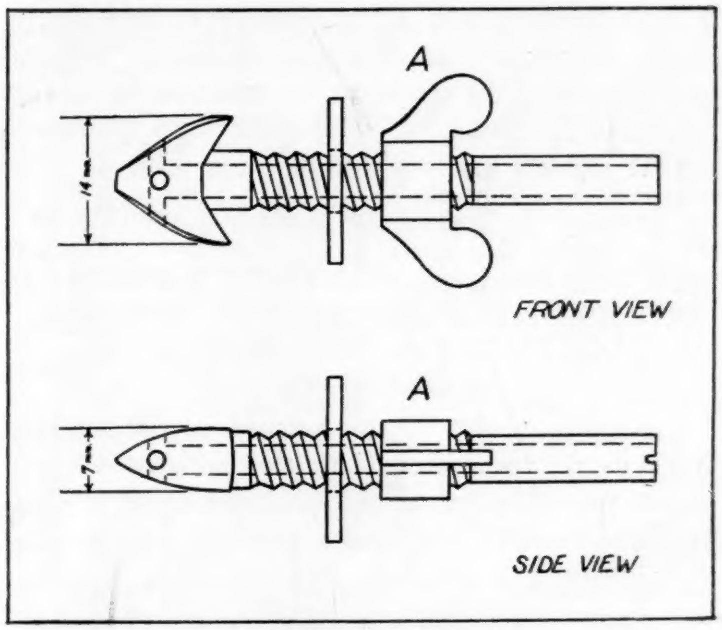

FIG. 1. Pleural Cannula

the four holes is seen near the tip of the barb. This cannula is introduced in much the same manner as any pleural cannula, except that the flattened sides of the barb should be introduced parallel with the borders of the ribs. When the cannula enters the pleural cavity, it is immediately given a turn of 90°. This will result in the barb points catching the ribs if you attempt to withdraw it. While firmly holding the cannula in this position, quickly tighten the wing-nut shown at A in Fig. 1. If the wing-nut is very firmly tightened, the cannula will now stay firmly anchored in the pleural cavity and the rubber tubing may be quite carelessly handled without danger of the cannula slipping out. The firm tightening of the wing-nut on the underlying washer effectively seals and prevents loss of negative pressure in the pleural cavity.

Certain precautions, if taken, will give better results. For example, it is best to insert the cannula where the rib borders lie in closest approximation; otherwise the barb will fail to engage the ribs and will come out. We usually choose the right side of the chest so that the heart will not be interfered with. The site chosen is about the midaxillary line and fairly high up on this line. It is best to cut the hair very short over the chosen site. It should be removed from a space about

[1] From the Department of Pharmacology of Boston University School of Medicine and the Evans Memorial Hospital.

two inches in diameter so that the hair will not become entangled in the cannula when the wing-nut is tightened. Having removed the hair, cut a slit about a half inch long between and parallel to the borders of adjacent ribs. You may then thrust the cannula quickly through the muscle tissue between the ribs, turn it through 90° quickly and then fasten the wing-nut. We have found it more satisfactory, however, to incise the intercostal muscles and parietal pleura because occasionally the cannula point strips the parietal pleura from the chest wall and pushes it ahead of it. By this method, the cannula slips in easier and since it is so quickly done, no respiratory distress results in the animal, even if the lung collapses. You can quickly restore the intrathoracic pressure by suction through a T-tube placed in the rubber tubing connecting the cannula with the recording tambour.

WALTER L. MENDENHALL

THE USE OF DIALYSIS IN THE PREPARATION AND PURIFICATION OF IMMUNOLOGICALLY ACTIVE BACTERIAL PRODUCTS*

THE problem of purifying active bacterial products is frequently complicated by the presence of non-specific ingredients derived from the nutrient medium. We have recently employed a purely physical operation, dialysis, to overcome this difficulty. The particular bacterial products investigated were those capable of eliciting the phenomenon of local skin reactivity to bacterial filtrates;[1] the method described, however, appears generally applicable to other bacterial products which are non-diffusible through Cellophane.

It was reported in a former communication[2] that the active principles of the phenomenon of local skin reactivity to bacterial filtrates are retained by Cellophane membranes. The observations of McClean[3] on production of staphylococcus toxin in fluid media diffused through Cellophane suggested the possibility of preparing active filtrates free from non-specific ingredients, as described below.

A diffused broth medium is prepared by immersing Cellophane[4] bags, containing saline, into nutrient broth. Sterilization is accomplished by autoclaving. After standing at room temperature for 24 hours, the inner contents are inoculated and the apparatus incubated. During the abundant growth in the bags, observed thus far with many microorganisms, the outside broth remains sterile. The production of potent culture filtrates under these conditions is consistent. The function of the outside broth is to supply diffusible nutrient substances to the growing bacteria. After various periods of incubation, the cultures are removed and filtered. The filtrates obtained in this manner are then redialyzed against saline, in Cellophane bags.[2] Diffusible substances which have not been rearranged to specific bacterial products are thus removed. In many cases, practically water-clear preparations are obtained. The final dialyzed solutions usually contain about 2 mgms total solids (ash free) and 0.02 mgms total nitrogen. The method is very practical, and large quantities of excellent starting materials for chemical investigations are readily prepared. They are considerably lower in total solids and nitrogen than most of preparations formerly analyzed.[2]

The filtrates give abundant precipitation with specific immune sera, thus apparently containing a considerable amount of antigenic material. The active principles of the phenomenon present in these preparations are of considerable potency. In the case of meningococcus, the reacting titer approximates one half of that of "agar washings" filtrates. It may be noted that filtrates of meningococcus cultures in fluid media without the use of Cellophane have ordinarily a potency of 1/40 to 1/20 of the "agar washings." These principles are specifically neutralized by immune sera in "multiple proportions."

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1 G. Shwartzman, "Phenomenon of Local Tissue Reactivity and its Immunological, Pathological and Clinical Significance." Paul B. Hoeber, Inc., Medical Book Department of Harper and Brothers, New York, 1937.

2 G. Shwartzman, S. Morell and H. Sobotka, *Jour. Exp. Med.*, 65: 323, 1937.

3 D. McClean, *Jour. Path. and Bact.*, 44: 47, 1937.

4 "Cellophane" No. 600 was used.

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